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FINAL TECHNICAL REPORT
NASA COOPERATIVE AGREEMENT

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1988-1992

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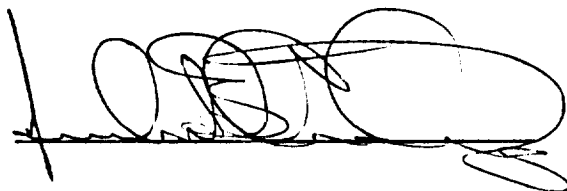
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HAMPTON UNIVERSITY
HAMPTON, VA

HERBERT ARMSTRONG
Principal Investigator

A handwritten signature in black ink, appearing to read 'Herbert Armstrong', written over a horizontal line.

August, 1992

This report is a compilation of all progress reports written since 1988. Until August 31, 1992, Hampton University took part in a NASA research grant NCC1-125, which enabled staff and students from Hampton University to interact with contractors and employees at NASA Langley Research Center. This interaction included several different studies in which Hampton University personnel participated. Hampton University personnel (workers) who participated under the grant were categorized as Research Aide-Type 1 or Research Aide-Type 2. Additionally, a full time worker (normally a graduate of the University's Airway Science Program) functioned as the student supervisor. The grant and the studies began in 1988 employing approximately eight (8) to ten (10) workers total. The following job descriptions apply:

Research Aide - Type 1

Duties/Responsibilities: The primary responsibility was to provide Pseudo-Pilot support for the NASA Langley MOTAS (Mission Oriented Terminal Area Simulation) Laboratory. Additional duties included: transcribing audio tapes; verifying and comparing research data; reproducing data in a multimedia environment (audio, computer, video, etc.); inputting computer data; filing and updating documents in support of research; creating graphs and other visual representations of data; and such other duties as the supervisor directed. Some travel was required. On rare occasions, evening work was required. Full-time summer work was available also.

Skills: Keyboard skills (student was trained), background or education in aviation was preferred, preferably an Airway Science major who had completed at least the basic Air Traffic Control course (AWS303), ability to work with minimal supervision, attentiveness to detail where accuracy was of the utmost importance, and reliability.

The number of students needed to work was four (4) or five (5) depending upon the budget authorization and needs of NASA. The number of hours worked per week was ten (10) to twenty (20) for part-time workers and forty (40) for the full-time worker. Work hours were flexible for part-time workers based upon student academic load as long as the needs of NASA were met. The hourly rate was five (5) dollars for part-time students and six (6) dollars for the full-time worker (non-student).

Research Aide - Type 2

Duties/Responsibilities: The primary responsibility was to provide Pseudo-Pilot support for the NASA Langley MOTAS Laboratory. Additional duties included: transcribing audio tapes; verifying and comparing research data; reproducing data in a multimedia environment; inputting computer data; filing and updating documents in support of research; creating graphs and other visual representations of data; and such other duties as the supervisor may direct. Some travel was required. On rare occasions, evening work was required. Full-time summer work was available for Type 2 workers also.

Type 2 Research Aides were also asked to create computerized data bases and/or spreadsheets, develop enhancements to the computer controlled NASA Pseudo-Pilot station, assist Type 1 Research Aides with computer data input, program mainframe and PC computers, and advise faculty members on in-house computer capability.

Skills: Keyboard was required, background or education in aviation, preferably an Airway Computer Science major who had completed AWS303, multiple computer science programming courses, knowledge of programming languages and computer systems was mandatory, and reliability was imperative.

The number of workers needed was two (2) or three (3) depending upon budget authorization and needs of NASA. Type 2 Research Aides could fill positions designated for Type 1.

Since 1988, there have been five (5) studies initiated and completed. The five are:

- 1) Base Line Controller (BLC),
- 2) Final Approach Spacing Aide (FASA),
- 3) Data Link Information Transfer (headed by Marvin Waller),
- 4) Data Link Information Transfer (headed by Charlie Knox and Charlie Scanlon), and
- 5) Weather Avoidance Design Evaluation.

The Base Line Controller (BLC) study was in operation for three (3) years (1988-1991). The purpose of BLC was to determine a base line of controller performance by measuring: controller strategies, workload, the number of controller instructions, separation margins, and how manual control differs from automation. During system development and data collection for the BLC study, Hampton University workers participated as Pseudo Pilots. As Pseudo Pilots, they assumed the role of simulated yet realistic aircraft for various test. Data analysis included transcribing audio tapes, comparison of transcripts to computer printouts, and recording these findings on EXCEL spreadsheets. Additional research assistance was provided by psychology majors who analyzed the job/task of pilots under Jon Johnson.

The Final Approach Spacing Aide (FASA) study was in operation for one (1) year (1990-1991). The FASA study dealt with researching and developing an Air Traffic Control

(ATC) automation aide to assist air traffic controllers on the final approach sequence. Its purpose was to evaluate several different display aides and find the most efficient method of aircraft spacing during final approach to an airport. During Systems development and data collection, Hampton workers participated as Pseudo Pilots. As in the BLC study, Pseudo Pilots assumed the role of simulated yet realistic aircraft in order to communicate with the test subjects.

Data Link is a method of communication between ATC and the aircraft. This method of communication was designed to enable accurate communication between ATC and the aircraft. Communicated information was channeled solely to one aircraft and could only be received by that particular aircraft. Also, the information was recorded for reference in case any communication was missed. Communication was channeled via touch video screens and keyboards with little or no voice communication. There were two (2) versions of Data Link. The first version which was headed by Marvin Waller, a researcher for NASA, was completed in May 1991. Hampton workers participated in both data collection and data analysis on this version of Data Link. The second was headed by Charlie Scanlon and Charlie Knox, contractors from Lockheed. Hampton workers participated in this version during data analysis. During this phase, students joined researchers out at Wallops Island and participated in one of the actual flight tests. This flight test took place during the Fall of 1990. All work on this particular version was finished in December 1990.

The Weather Avoidance Design Evaluation was a study designed to evaluate how pilots react to and avoid different weather situations (such as thunderstorms). Data

collection for this study lasted six (6) weeks (June, 1991-August, 1991). In the data collection phase, it was required that two (2) Hampton workers participate in performing ATC, Pseudo Pilot, and dispatch duties. The duties of the participants were to provide weather information as well as enroute information during the flight of the test aircraft. Background information included conversations for vectoring, altitude changes, and frequency changes. The most important information that Hampton workers provided was enroute weather information.

In addition to the studies that were performed, Hampton workers did some educational research which included investigating Flight Service Stations (FSS's), ATC-related National Transportation Safety Board accident reports, the history of air traffic control and major airports of the world. This research was conducted between October, 1991 and July, 1992.

In researching FSS's, workers analyzed all types of information that were provided by FSS Specialists. Workers also investigated automated flight service stations to determine how they operated. Researching ATC-related accidents involved finding and reviewing NTSB accident reports that were caused (or contributed to) by air traffic controllers.

The research performed on the major airports of the world involved looking at structures of the top fifty (50) United States airports and verifying the runway lengths and widths as well as the projections for the future of each. Also, this research involved

researching major Atlantic and Pacific "rim" airports for the same purpose as the U.S. airports. Upon completion of Hampton participation in the research of the major airports of the world, the grant was terminated.

Financial data for the end-of-grant report will be provided to NASA by the Hampton University business office.